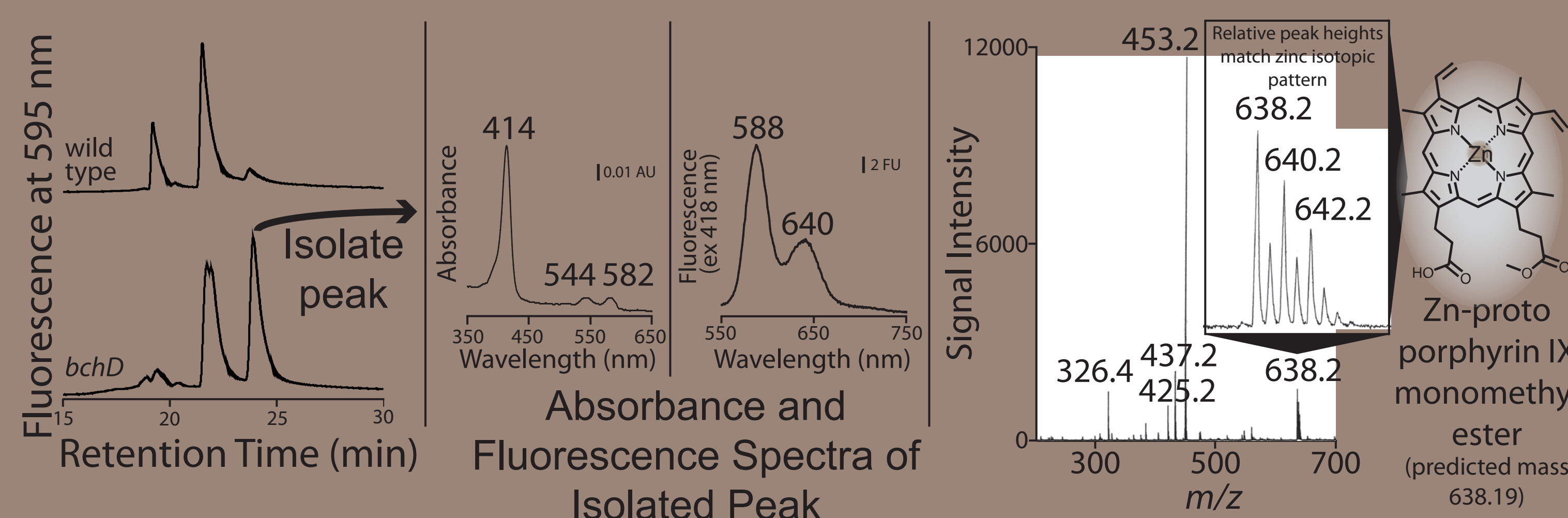


Out of the Blue

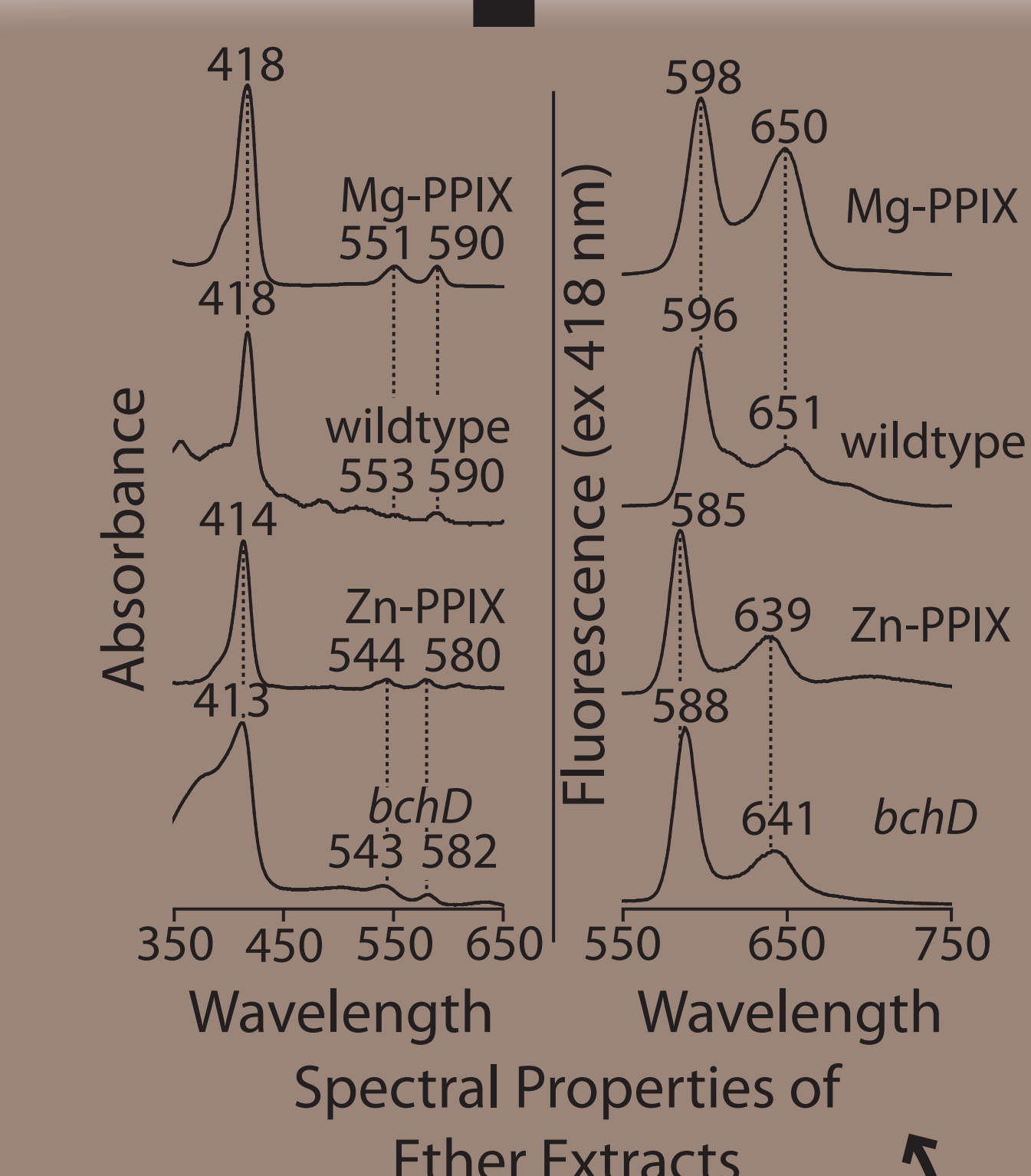
In a mutant lacking the magnesium-chelatase complex, we find zinc-bacteriochlorophyll incorporated into the photosystem and a new way to make bacteriochlorophyll

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Featuring research and assistance from: Su Lin, Haiyu Wang, Rafael Saer, Elizabeth Digby, Mark Paddock, Aaron Tufts, James P. Allen, Federico I. Roselle, A. Grant Mauk, and Neal W. Woodbury

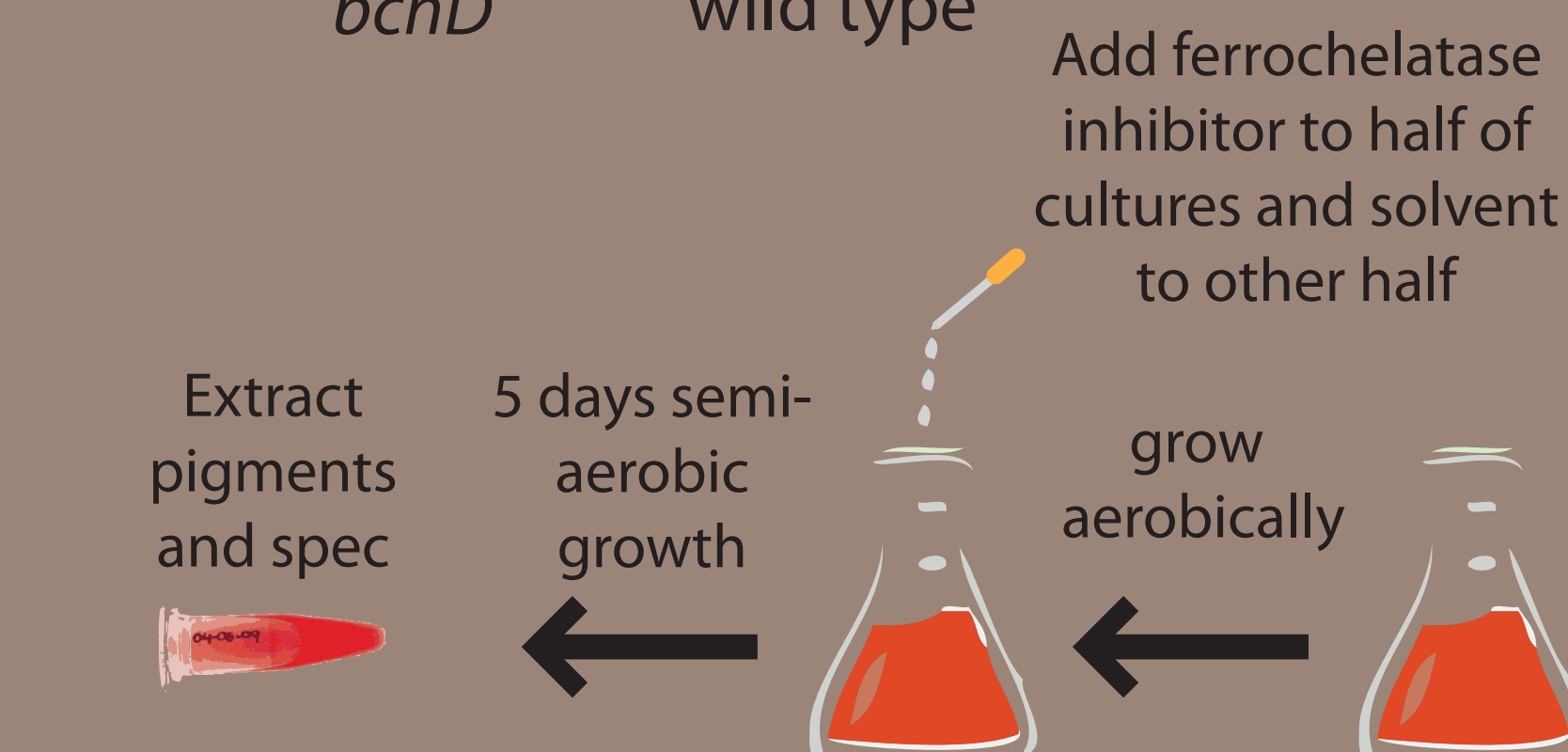
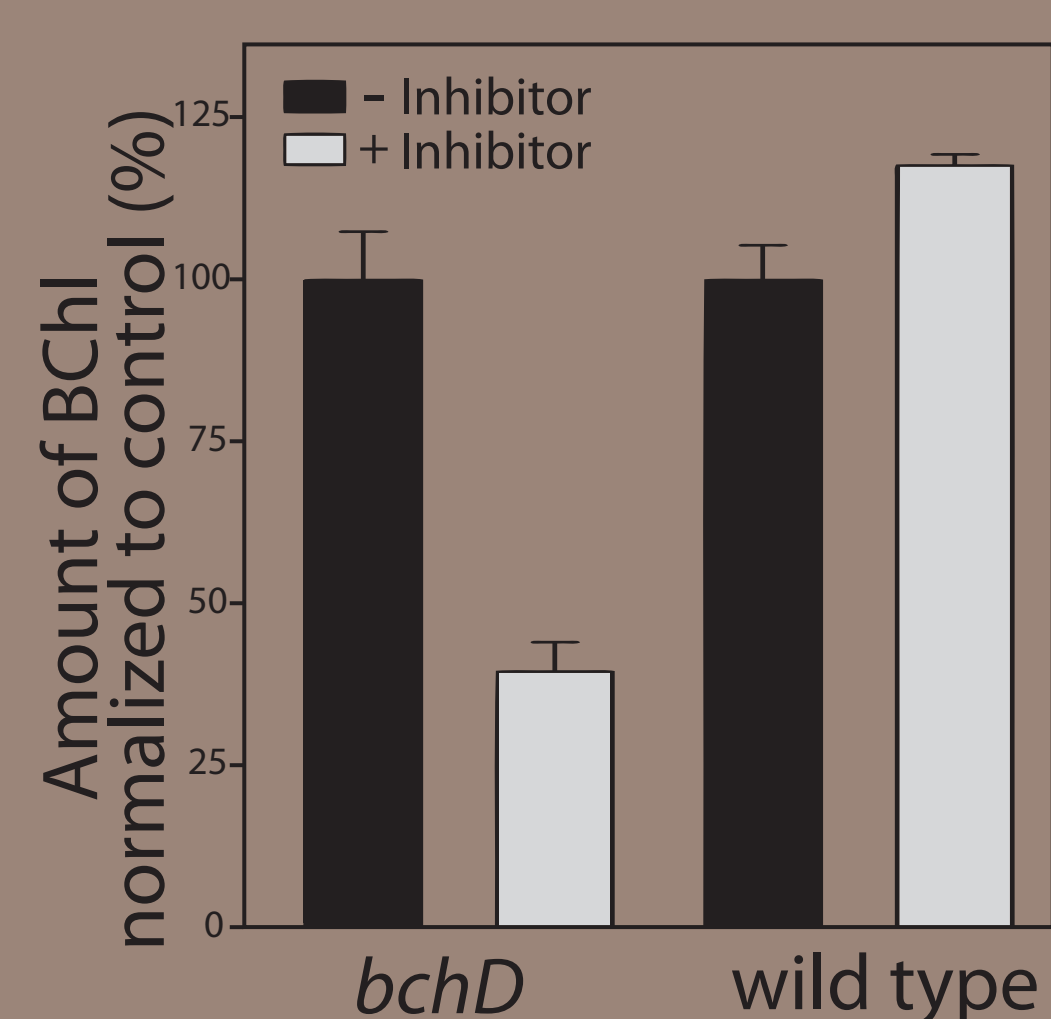


Yes, separating the crude porphyrins shows that the *bchD* mutant produces a zinc containing intermediate of the BChl-pathway.

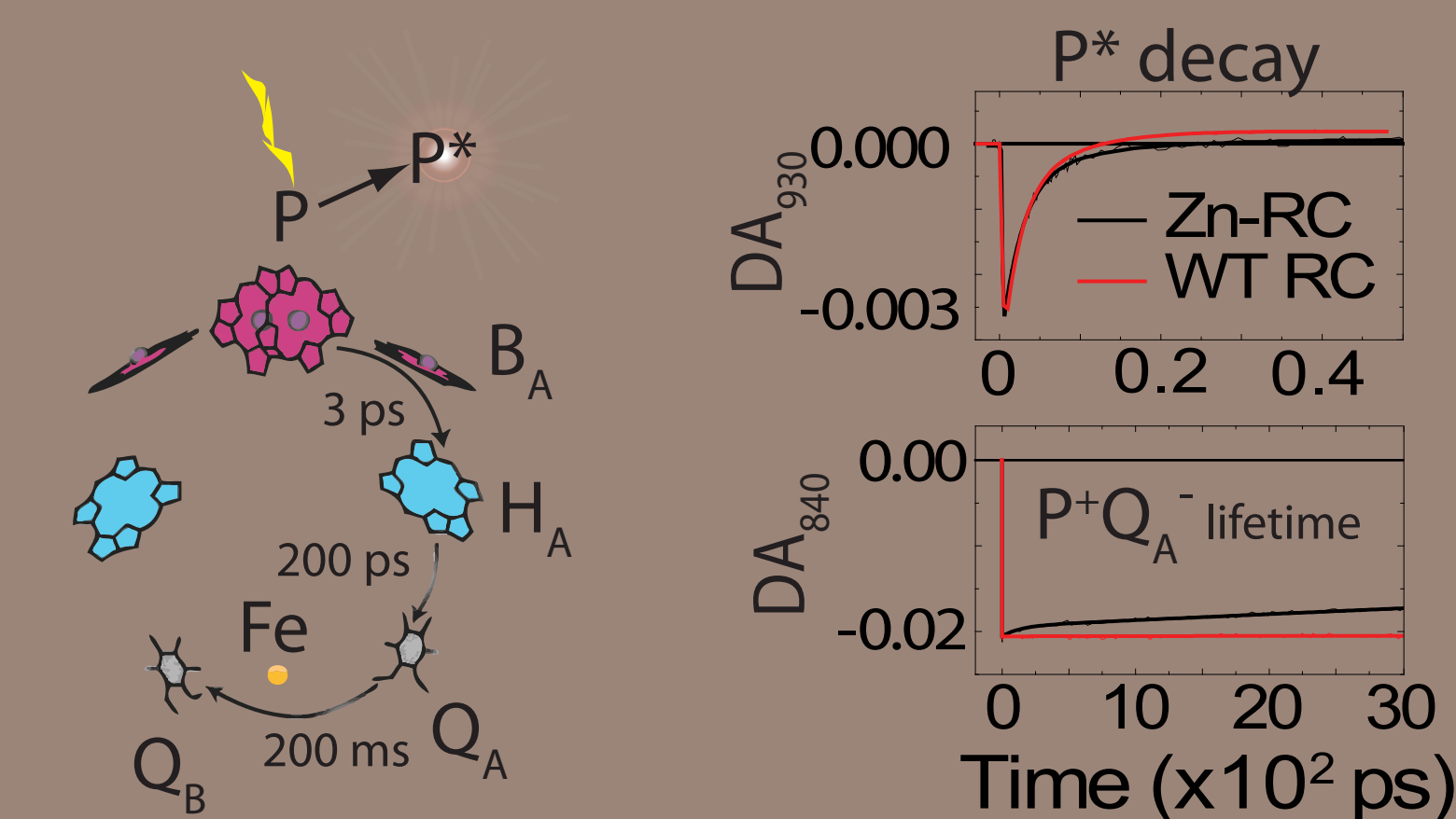


Is Zn added early in the pathway? Do cell extracts contain Zn-porphyrins?

How is Zn-BChl synthesized?
Ferrochelatase, an enzyme known to make Zn-protoporphyrin IX, may be involved.



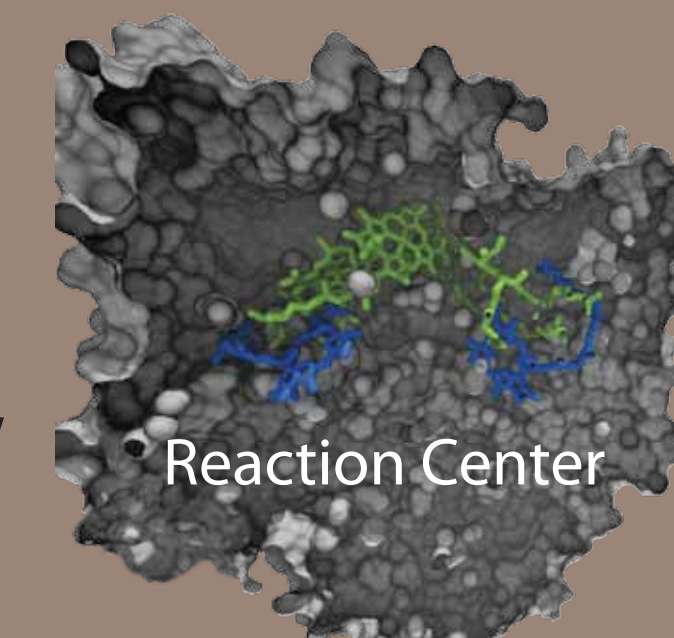
Is the photochemical reaction center less efficient with Zn-BChl?



No, they function almost as wild type. Growth deficiency is due to low levels of chlorophyll.

Lin S, et al. (2009). Electron transfer in the *Rhodobacter sphaeroides* reaction center assembled with zinc bacteriochlorophyll. *Proc Natl Acad Sci USA* 106: 8537-8542.

We wanted to know if photosystem proteins can assemble without the chlorophyll 'glue'



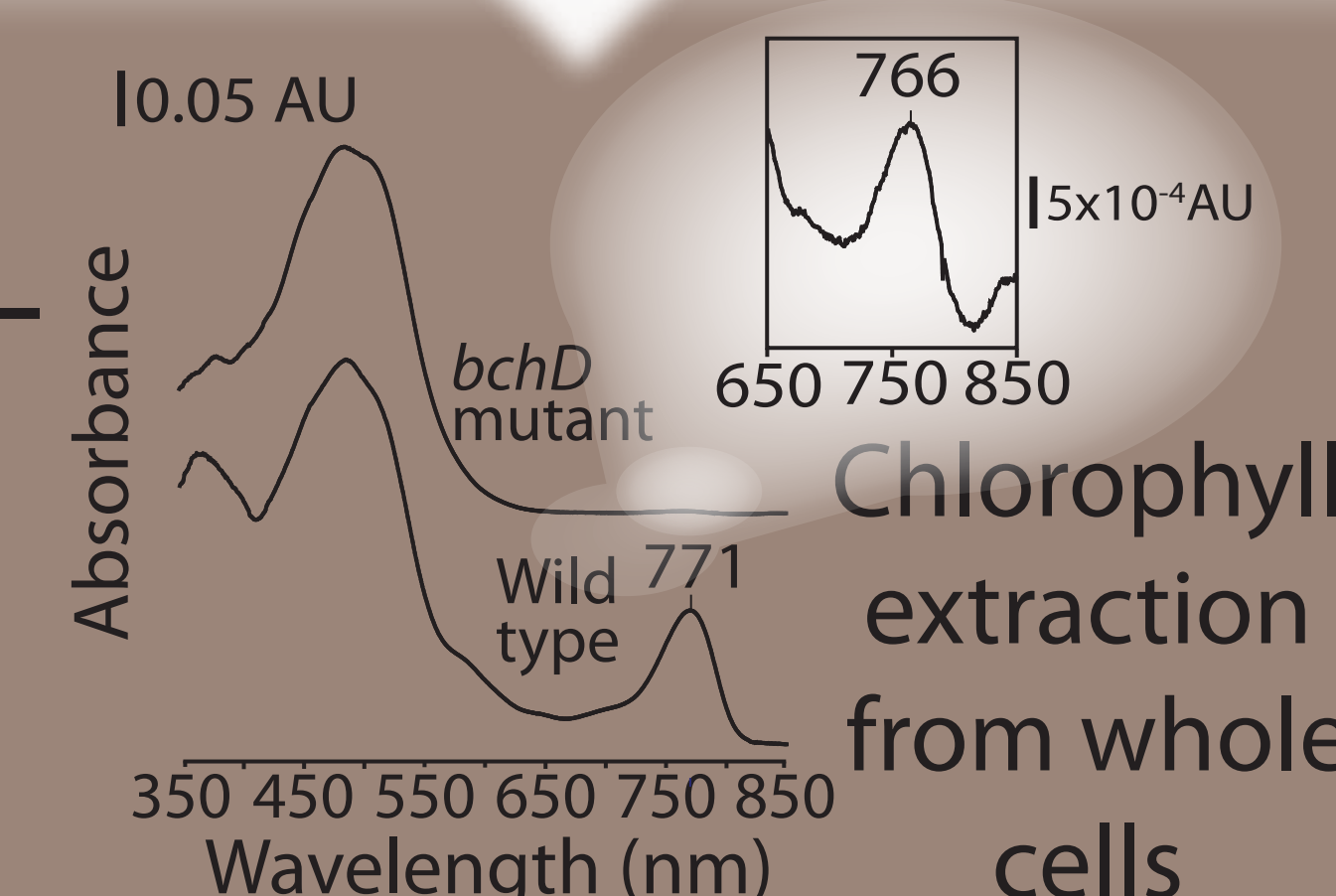
The *bchD* mutant has a knockout in a subunit of the Mg-chelatase



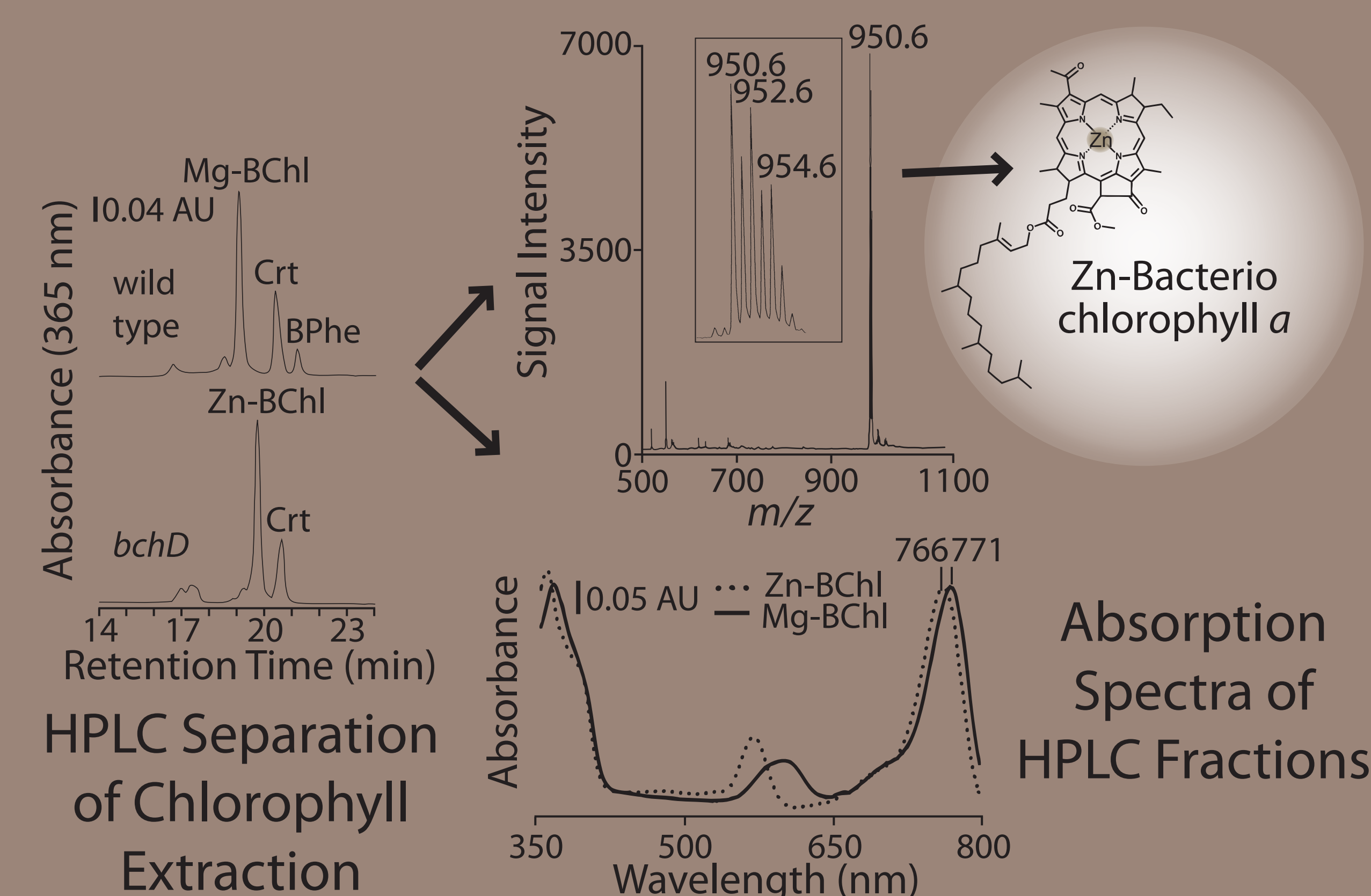
Coomber SA et al. (1990). Localized transposon Tn5 mutagenesis of the photosynthetic gene cluster of *Rhodobacter sphaeroides*. *Mol Micro*. 4(6): 977-89.

Mutant phenotype: Grows photosynthetically? No

Chlorophyll?....



...still making chlorophyll, BUT, with Zn in the porphyrin ring instead of Mg



So...why can't they grow photosynthetically?

Jaschke PR & Beatty JT. (2007). The photosystem of *Rhodobacter sphaeroides* assembles with zinc bacteriochlorophyll in a *bchD* (magnesium chelatase) mutant. *Biochemistry*. 46(43): 12491-500.

Acidiphilium rubrum: the first discovered Zn-BChl producer

- aerobic photoheterotroph
- lives in acidic environment (pH 2.5-3.5)
- contains 13:2:1 ratio of Zn-BChl to Mg-BChl to BPheo

Wakao N, et al. (1996). Discovery of natural photosynthesis using Zn-containing bacteriochlorophyll in an aerobic bacterium *Acidiphilium rubrum*. *Plant Cell Physiol*. 37(6): 889-893